HEART

Editorial

Transferring patients for primary angioplasty

The success of fibrinolysis in the treatment of myocardial infarction has been attributed to reperfusion of the occluded vessel, however, it has become clear that it is not just reperfusion but restoration of normal flow—defined angiographically as TIMI-3 flow—in the infarct related artery that dictates mortality. Analysis of the different treatment arms of GUSTO-I,[1] the PAMI trials,[2 3] and the primary angioplasty registry,[4] demonstrates a very clear inverse linear relation between mortality and the rate of TIMI-3 flow achieved in the infarct related artery. The randomised trials of primary angioplasty in acute infarction[2 5 6] all point to it being superior to thrombolytic therapy in achieving this goal, although in the GUSTO-IIB substudy[7] the benefit was less marked.

The trials of thrombolytic therapy versus placebo all demonstrated a time dependent benefit, the shortest "pain to needle" times having the lowest mortality with a cut off at approximately six hours. This has led to Department of Health guidelines, frantic (albeit appropriate) efforts to keep door to needle times as short as possible, and the consideration of prehospital thrombolysis.[8]

The observed decline in benefit of thrombolytic agents with time not only relates to continuing loss of potentially salvageable myocardium but also to the lower potency of agents on the more established thrombus. The same time dependent decline is seen in the trials of primary angioplasty within the high risk categories such as cardiogenic shock but is far less marked in the non-shocked patients. Indeed one of the striking features of the PAMI-2 trial was the consistently lower mortality seen in the angioplasty group even when pain to balloon time was six hours or more. This may be explained by the fact that even at this late stage angioplasty achieves TIMI-3 flow in 90% or more patients compared with 28% for thrombolytic agents. Such a preserved response to treatment suggests there may be some leeway in the time to treatment if angioplasty is the chosen treatment modality, maybe enough leeway to allow time to transport patients if angioplasty facilities are not immediately available.

Transporting patients for primary angioplasty is not new. The Mid-American Heart Institute under the direction of Hartzler has, since 1981, treated thousands of acute myocardial infarction patients from considerable distances reporting great success.[9 10] Lubbock Hospital in Texas currently takes patients from a radius of up to three hours flying time—an equivalent area would encompass almost the whole of the British Isles—with remarkable speed and effectiveness. In this edition the Zwolle group, in a retrospective analysis of its primary angioplasty practice over the past few years, reports equivalent outcomes in patients transferred from up to 60 miles away and those admitted directly.[11]

Could such transfer arrangements be translated to Great Britain with its hard pressed ambulance service and sparse interventional centres? The Zwolle group reports 104 patients transferred from 14 surrounding hospitals in a five year period, a referral rate of 1.5 patients per year per centre, a remarkably small number. These patients were a selected population being ineligible for thrombolysis and/or high risk patients as defined by clinical criteria. Based on our experience in the Exeter primary angioplasty pilot study (EXPAPS)[12] the equivalent clinical definition would produce a minimum of 80 patients aged 79 or younger per year for a catchment population of 330 000. The southwest region (typical of many areas of Great Britain) has a population of 3.5 million and would produce 800 such cases annually for its only interventional centre, some travelling up to 200 miles—not a practical proposition. But considering transfer of such patients ignores the fact that it is the immediate angiogram that defines the high risk patient far better than the clinical presentation as was demonstrated by the PAMI-2 study[13] and supported by our own experience. If angiographically high risk patients were included it would increase the above by at least 50%.

Zijlstra *et al* use their data to recommend and support a large randomised trial comparing locally administered thrombolysis with transfer for primary angioplasty in clinically high risk patients.[11] There seems little doubt that such a trial will show a benefit in the angioplasty arm, just as the preliminary results from the equivalent US trial (AIR-PAMI) are already suggesting; however, this does not mean that we should adopt such a strategy as routine. That could result in a suboptimal service with a large number of eligible patients at risk being excluded.

If it is to be accepted that primary angioplasty is the superior reperfusion strategy for acute myocardial infarction then it should be available on a nationwide basis to all patients. If it is deemed prudent to offer it only to high risk patients then we must make sure we can define high risk adequately by the use of expedient angiography. A simple guideline target should suffice—for example, TIMI-3 flow should be established within 90 minutes of presentation in 60% and within 120 minutes in 90% of patients presenting with acute myocardial infarction. Local geographical considerations will then determine what is done to achieve the proscribed and easily audited target. After all if we can apply rules about the availability of lifesaving emergency surgical reperfusion in the event of an iatrogenic coronary occlusion,[14] surely we should apply similar rules about emergency reperfusion of the much more common spontaneous variety.

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STAMPS IN CARDIOLOGY

Willem Einthoven (1860–1927)

The Institute of Cardiology in Mexico was created in 1944 by Professor Ignacio Chavez and it has two large murals in the entrance hall that were painted by the eminent artist Diego Rivera. These murals illustrate the history of the heart and circulation and they have the portraits of many famous men. A portion of the mural appears on an 80 centavos airmail stamp and it has Einthoven as the central figure. The issue was limited to one million stamps. Diego Rivera was also the designer of this stamp, which was one of two that were issued on 8 April 1972 to mark the World Health Month of the World Health Organisation, the theme for 1972 being "Your heart is your health".

On 7 September 1993 the Netherlands issued a set of three stamps featuring Dutch Nobel Prize winners. The middle 80 cents value stamp features Einthoven and his electrocardiogram and commemorates his Nobel Prize for Medicine awarded in 1924. The other two stamps feature van der Waals (Nobel Prize for Physics in 1910) and Eijkman (Nobel Prize for Medicine in 1929). The stamps were designed by Tessa van der Waals from Amsterdam.

Willem Einthoven (1860–1927) was the father of modern electrocardiography. The electrical activity of the heart had first been demonstrated in 1842, and in 1887 by using Lippmann's capillary electrometer Augustus Waller made the first human recording, which he named the electrocardiogram. But the tracings with this apparatus were heavily damped and Einthoven set about designing a new type of instrument in the early 1890s when he was professor of physiology in Leiden, Holland. In 1901 he described his invention of a string galvanometer that yielded electrocardiograms of superb quality, as shown when he published the first one in 1902. The string galvanometer consisted of a very thin silver coated quartz fibre ("the string") suspended between the poles of an electromagnet. An image of the string, magnified 600 times, was projected onto a photographic plate. His apparatus was the standard equipment until direct writing instruments came into use 50 years later, and the quality of the recordings made with it has not been surpassed. It was he who named the deflections P Q R S T and U.

Einthoven was essentially a physicist and after a detailed examination of the problems involved, his design approach was based on physical and mathematical methods. His invention was founded on a long and profound study of the theoretical and practical aspects of the problem, and without his work it is quite possible that clinical electrocardiography would have been considerably delayed. His undoubted genius was recognised by the award in 1924 of the Nobel Prize for Physiology of Medicine. Furthermore, although he was not a physician, he was one of the first to recognise that the electrocardiogram would be important in the diagnosis of heart disease. In this connection he greatly admired the work of Thomas Lewis who was foremost in the development of experimental and clinical electrocardiography.

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